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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/730,041	12/09/2003	Kanwal K. Raina	M4065.0206/P206-C	2998

24998 7590 06/07/2007

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EXAMINER	
LIN, JAMES	

ART UNIT	PAPER NUMBER
1762	

MAIL DATE	DELIVERY MODE
06/07/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/730,041	RAINA, KANWAL K.	
	Examiner	Art Unit	
	Jimmy Lin	1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 April 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *24-38* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *24-38* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 4/11/2007 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 24 and 30-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Itoh et al. (5,469,014) in view of Cathey et al. (U.S. Patent No. 5,853,492) and Miyamoto (U.S. Patent No. 5,747,384).

Itoh discloses a method of making a field emission element usable in a display device (col. 1, lines 7-11). An emitter 8 can be formed on substrate 2. The emitter can be made from titanium (Ti) and the surface layer can be converted to TiN by ion implantation of nitrogen (i.e., a nitrogen infusion process).

Itoh does not explicitly teach a hydrogenation process comprising a plasma enhanced chemical vapor deposition process conducted in the presence of silane gas. However, Itoh teaches the need to prevent an oxide layer from forming on the surface of the emitter (cols. 1-2).

Cathey teaches that the formation of native oxide on the emitters increases the work function, which negatively impacts the performance of the emitter (col. 1, lines 35-57). Removal of the native oxide layer can be performed via a hydrofluoric acid step (col. 2, lines 33-40).

Miyamoto teaches that a plasma treatment can further remove a native oxide film after a hydrofluoric acid process (col. 6, lines 40-49). The plasma treatment can include a gaseous mixture consisting of hydrogen gas, silane gas, and argon gas (col. 5, lines 31-35).

In light of these teachings, it would have been obvious to one of ordinary skill in the art at the time of invention to have performed a hydrofluoric acid step and a plasma treatment with silane gas to remove a native oxide layer on the emitter of Itoh with a reasonable expectation of success. One would have been motivated to do so in order to have kept the work function of the emitter as low as possible.

Claim 30: Itoh, Cathey, and Miyamoto do not explicitly teach that the hydrogenation process and the nitrogen infusion process are performed on a plurality of emitters. However, Cathey does teach that a typical field emission device has a plurality of emitters (Fig. 1). The combination of references would have reasonably suggested performing the same steps on all of the emitters.

Claim 31: Cathey teaches that the emitters can be sealed (Fig. 2).

Claim 32: Itoh teaches that the tips of the emitters are treated.

4. Claims 24, 26, and 29-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al. (U.S. Patent No. 6,323,587) in view of Miyamoto '384.

Zhang discloses a method of making a field emission display. An emitter 30 can be formed on substrate (Fig. 2). The emitter can be treated with a native oxide removing step using a conventional hydrogen fluoride etching step (col. 4, lines 13-18) and a nitrogen infusion process (col. 4, lines 35-41).

Zhang does not explicitly teach that the native oxide removing step can be a plasma enhanced chemical deposition process in the presence of silane gas. However, Zhang does teach that other methods can be used. Miyamoto teaches that a silane plasma treatment is an operable method for removing a native oxide layer. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to have used a silane plasma treatment as the particular method to remove native oxide because Zhang is open to any conventional method and because Miyamoto teaches that such a method is well known. The selection of something based

on its known suitability for its intended use has been held to support a prima facie case of obviousness. Sinclair & Carroll Co. v. Interchemical Corp., 325 U.S. 327, 65 USPQ 297 (1945).

Claim 26: Zhang teaches that the nitrogen infusion process can be conducted with ammonia gas (col. 4, lines 35-41).

Claim 29: Zhang teaches that the emitter includes a base portion surrounded by an insulator 34 and that the emitter extends beyond the insulator layer (Fig. 2).

Claim 30: Zhang teaches that the field emissive element can have a plurality of emitters (col. 1, lines 34-35).

Claim 31: Zhang teaches that the emitters can be sealed (col. 1, lines 22-25).

Claim 32: Zhang teaches that the tips of the emitters are treated.

5. Claims 25-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Itoh '014 in view of Cathey '492 and Miyamoto '384 as applied to claim 24 above, and further in view of Sung et al. (U.S. Patent No. 6,171,927).

Itoh, Cathey, and Miyamoto are discussed above, but do not explicitly teach that the nitrogen infusion process is conducted in the presence of ammonia gas. However, Itoh does teach that the nitrogen infusion process is an ion implantation of nitrogen.

Sung teaches that conventional ion implantation using nitrogen gas is an operable equivalent of a plasma source ion implantation using ammonia gas. One of ordinary skill in the art would have expected the two ion implantation methods to have similar results. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to have used a plasma ion implantation with ammonia gas, as opposed to a conventional ion implantation with nitrogen gas, as the particular nitrogen infusion process of Itoh with a reasonable expectation of success because Sung teaches that such processes are operable equivalents. Substitution of equivalents requires no express motivation (see MPEP 2144.06).

Claim 25: Itoh, Cathey, and Miyamoto do not explicitly teach that the plasma ion implantation step (i.e., the nitrogen infusion step) and the plasma treatment are performed in the same chamber. However, it is very well known in the art that performing successive steps in the same chamber reduces the number of processing steps (and thus the manufacturing cost) and reduces the opportunity for contamination. Thus, it would have been obvious to one of ordinary

skill in the art at the time of invention to have performed both plasma treatment steps in the same chamber in order to have reduced the risk of contamination and to have reduced the number of process steps with a reasonable expectation of success.

Itoh, Cathey, and Miyamoto do not explicitly teach the order of performing the nitrogen infusion process and the plasma treatment. However, the selection of any order of performing process steps is *prima facie* obvious in the absence of new or unexpected results. See, for instance, *In re Burhans,* 154 F.2d 690, 69 USPQ 330 (CCPA 1946). One of ordinary skill in the art would have expected similar results for performing either of the process steps first. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to have performed the plasma treatment first, as opposed to performing the nitrogen infusion step first, with a reasonable expectation of success because the Applicant has not provided any unexpected results for performing the order of steps and one of ordinary skill would have expected similar results in performing the steps in any order.

6. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Itoh '014 in view of Cathey '492 and Miyamoto '384 as applied to claim 24 above, and further in view of Doan et al. (U.S. Patent No. 5,186,670).

Itoh, Cathey, and Miyamoto are discussed above. Itoh teaches that the emitter includes a base portion surrounded by an insulator 4, but does not explicitly teach that the emitter extends from the insulator. However, Doan demonstrates the suitability of configurations in which the emitter may extend beyond the insulator (Fig. 2). Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to have formed the emitter of Itoh to protrude from an insulating layer because Doan teaches that such structures are operable configurations in the art. The selection of something based on its known suitability for its intended use has been held to support a prima facie case of obviousness. Sinclair & Carroll Co. v. Interchemical Corp., 325 U.S. 327, 65 USPQ 297 (1945).

7. Claims 33-34 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Itoh '014 in view of Cathey '492 and Miyamoto '384 as applied to claim 24 above, and further in view of Maa (U.S. Patent No. 4,411,734).

Itoh, Cathey, and Miyamoto are discussed above, but do not explicitly teach that the tips are exposed to a plasma hydrogenation process in the presence of silane with a flow rate of about 1200 sccm, an RF power of about 200-300 W, a pressure of about 1200 mtorr, and a period of about 5-10 minutes.

The focus of Maa (Examples) on the process variables such as pressure, gas flow rates, and RF power suggests that the flow rates of the materials are result-effective variables. Maa likewise indicates that the power, pressure, and time are result-effective variables during the plasma cleaning of native oxides (col. 2, line 66-col. 3, lines 10). Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to have chosen the optimum pressure, RF power, and silane flow rate through routine experimentation.

8. Claims 27, 33-35, and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang '587 in view of Miyamoto '384 as applied to claim 24 above, and further in view of Maa '734 for substantially the same reasons as discussed above.

9. Claims 27 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Itoh '014 in view of Cathey '492, Miyamoto '384, and Sung '927 as applied to claim 26 above, and further in view of Maa '734 for substantially the same reasons as discussed immediately above.

10. Claims 28, 36, and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Itoh '014 in view of Cathey '492, Miyamoto '384, Sung '927, and Maa '734 as applied to claims 27 and 35 above, and further in view of Iyer et al. (U.S. Patent No. 5,917,213).

Itoh, Cathey, Miyamoto, Sung, and Maa are discussed above, but do not explicitly teach that the nitrogen infusion process is performed with an ammonia gas flow rate of 500 sccm, an RF power of about 300-400 W, a chamber pressure of 1200 mtorr, and a period of about 10-15 minutes.

Iyer teaches that during plasma nitridation process, the pressure, gas flow rate, power, and time are chosen to achieve the desired results (col. 5, line 59-col. 6, line 19). Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to have

optimized the pressure, gas flow rate, power, and time in order to have achieved the desired results through routine experimentation

11. Claims 25, 28, 36, and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang '587 in view of Miyamoto '384 and Maa '734 as applied to claim 27 above, and further in view of Sung '927 and Iyer '213.

Zhang, Miyamoto, and Maa are discussed above, but do not explicitly teach that the nitrogen infusion process requires any sort of RF power (i.e., to generate a plasma). However, Zhang does teach that the nitrogen infusion step uses ammonia to add nitrogen to the emitter layer (col. 4, lines 35-41). Sung teaches that it is suitable to add nitrogen to a layer via plasma source ion implantation using ammonia. One of ordinary skill would have expected that the two nitrogen infusion steps are operable equivalents and would have used one method over the other with the expectation of similar results. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to have used an ammonia plasma source ion implantation step as the particular nitrogen infusion step with a reasonable expectation of success because Sung teaches that such a method is operable for adding nitrogen into a layer. Substitution of equivalents requires no express motivation (see MPEP 2144.06).

Sung does not explicitly teach that the nitrogen infusion process is performed with an ammonia gas flow rate of 500 sccm, an RF power of about 300-400 W, a chamber pressure of 1200 mtorr, and a period of about 10-15 minutes. However, such is obvious over Iyer, as discussed immediately above.

Claim 25 is obvious for substantially the same reasons as discussed above.

Double Patenting

12. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re*

Goodman, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

13. Claims 24-38 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-12 of U.S. Patent No. 7,101,586. Although the conflicting claims are not identical, they are not patentably distinct from each other because they merely represent different combinations and permutations of the various claimed features.

14. Claims 24-26, 30, and 32 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 6-7, 14, and 16 of U.S. Patent No. 6,471,561 in view of Cathey '492 and Miyamoto '384. The present claims do not teach a plasma treatment in the presence of silane gas. However, such is obvious over Cathey and Miyamoto, as discussed above.

Conclusion

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Ahn et al. (2004/0189175) teaches a method of nitrogen infusion on the emitter tip of a field emission device.

Response to Arguments

16. Applicant's arguments with respect to claims 24-38 have been considered but are moot in view of the new ground(s) of rejection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jimmy Lin whose telephone number is 571-272-8902. The examiner can normally be reached on Monday thru Friday 8AM - 5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tim Meeks can be reached on 571-272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JL

JL

KEITH HENDRICKS
PRIMARY EXAMINER